BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Mechanical Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Manufacturing Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Engineering (Optional unit) Pearson BTEC International Level 3 Extended Diploma in Electrical/Electronic Engineering (Optional unit) Pearson BTEC International Level 3 Extended Diploma in Mechanical Engineering (Optional unit) Pearson BTEC International Level 3 Extended Diploma in Manufacturing Engineering (Optional unit) Pearson BTEC International Level 3 Extended Diploma in Aeronautical Engineering (Optional unit)
Unit number and title	**Unit 28: Dynamic Mechanical Principles in Practice**
Learning aim(s)	**B:** Investigate the characteristics of uniform centripetal acceleration that is applied in mechanical systems
Assignment title	2 Centripetal acceleration and centrifugal force.
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You have been working with the Senior Design Engineer as part of your apprenticeship with a company that designs and supplies complex mechanical products for a wide range of industries. The Senior Design Engineer has asked you to carry out a series of calculations based on simple and complex rotating systems, in preparation for working on the design of customer products.
Task 1	You have been asked to investigate how simple and complex rotational systems can be modelled mathematically to predict how they will operate. **To do this:** You will produce a report detailing the solution of a series of problems related to simple and complex systems involving rotation. Your report should clearly indicate your understanding of each problem, the selection and application of appropriate mathematical models to solve them, and the relevance of the solutions obtained. **Problem 1**

A light aircraft has a mass of 4000kg. It is circling an airport at a speed of 150m/s at a radius of 1000m. Calculate the

a) centripetal acceleration
b) centripetal force

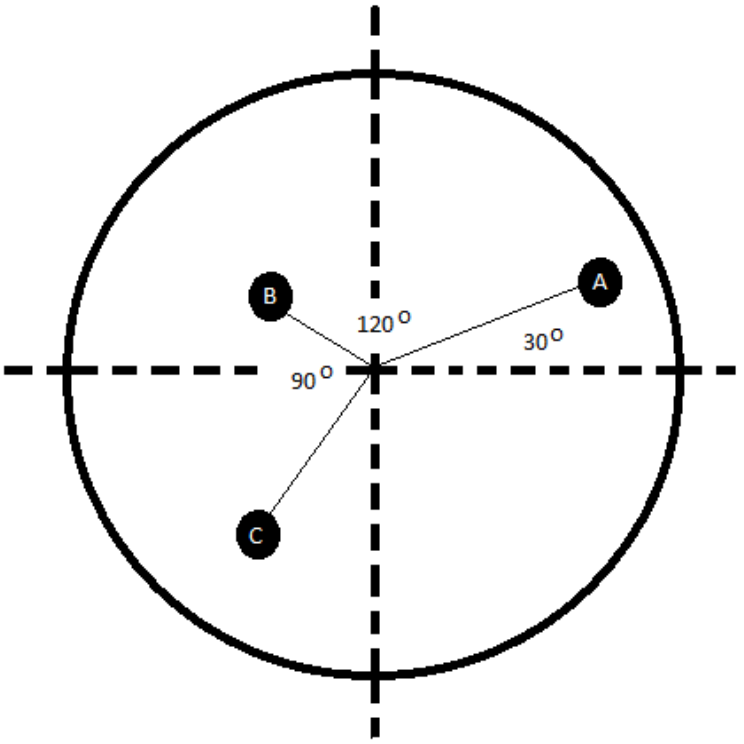
Problem 2

A mass of 20g is placed on a flat disc. It is connected to the centre of the disc by a spring 20cm long. The spring constant is 35N/mm. The disc is spinning at 2000rpm. Calculate the

a) centripetal acceleration
b) centripetal force
c) extension of the spring

Problem 3

Three masses, labelled A, B and C are placed on a rotating disc as shown. The masses are 2kg 1.5kg and 1kg respectively. The radius of each mass from the centre of the disc is 100mm, 50mm and 75mm respectively.



Calculate the mass placed at a radius given by your tutor needed to balance the disc, and where it should be placed by carrying out the following steps;

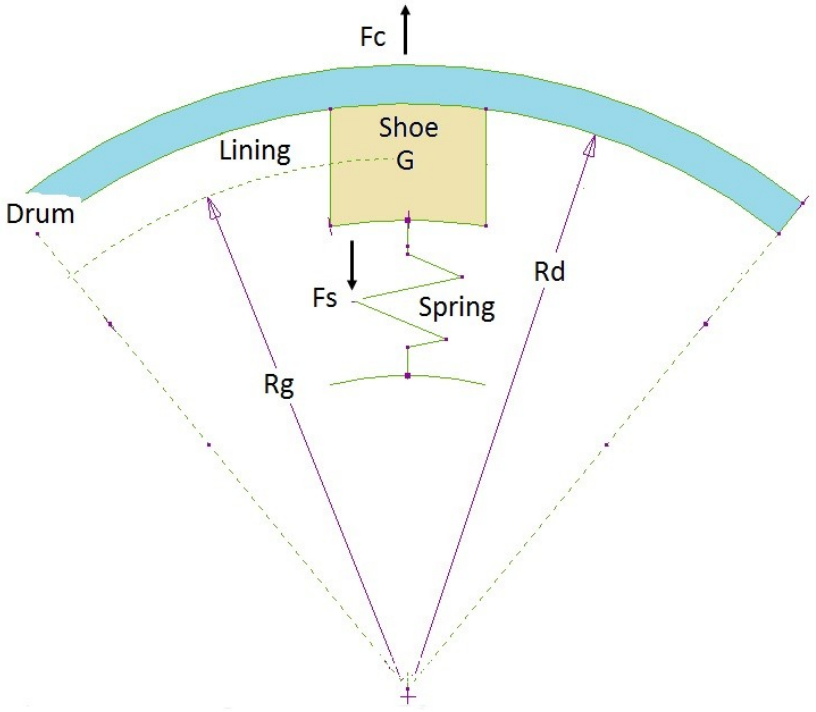
a) complete the table

	Mass (kg)	Radius (mm)	Mr (kg mm)
A			
B			
C			

b) draw the **Mr vector polygon** to scale
c) use the resultant to determine the mass M, and its position relative to A.

Problem 4

A centrifugal clutch has four shoes which slide radially in a spider keyed to the driveshaft. Each shoe is pulled back to a stop by a spring when at rest. When the clutch is engaged the shoes make contact with the inner surface of a cylindrical drum keyed to the driven shaft.



Calculate the total frictional force using the data supplied by your tutor.

Problem 5

A car has a wheelbase of 2.0m (sideways). Its centre of

	gravity is 0.8m above the ground. Calculate the smallest radius of bend that the car can negotiate without (a) sliding and (b) overturning at a speed of 120km/h. Assume the coefficient of friction between the tyres and the ground is 0.4. **Problem 6** Calculate the same values for the car in problem 4 if the bend is banked at an angle of 15°.
Checklist of evidence required	A report containing the worked solutions to the problems on rotation in simple and complex and complex systems. The calculations should include brief explanations of the methods selected and applied, relevant line diagrams, appropriate units and analysis of the results in terms of their accuracy.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
28/B.D2	Evaluate accurately the performance of simple and complex rotating systems due to the effects of centripetal acceleration, determining dynamic equilibrium for the unbalanced system.
28/B.M3	Determine accurately the performance of a simple and a complex rotating system due to the effects of centripetal acceleration, determining dynamic equilibrium for the unbalanced system.
28/B.P3	Calculate the centripetal acceleration and forces acting in a simple rotating system.
28/B.P4	Determine dynamic equilibrium for a simple system of unbalanced rotating masses.

Sources of information to support you with this Assignment	Books BTEC Level 3 National Engineering Student Book (Level 3 BTEC National Engineering); Buckenham et al; Pearson Education (2016); ISBN-13: 978-1292141008 Mechanical Engineering; Darbyshire A; Routledge (2010); ISBN-13: 978-0080965772 Mechanical Engineering Principles; Bird, Ross; Routledge (2014); ISBN-13: 978-1138781573 Websites miniphysics.com/a-level-physics-revision-notes-junior-college-physicsh1-h2.html Further useful resources may be found at qualifications.pearson.com/en/support/published-resources.html#step1
Other assessment materials attached to this Assignment Brief	*A formula sheet for linear and rotational relationships.* *Data sheet for Problem 3*

		Sample data for Problem 4							
		A	B	C	D	E	F	G	H
Number of shoes	n	4	4	4	4	4	4	4	4
Mass per shoe	m (kg)	1	1	1	1	1	1	1	1
Running speed	N2 (rpm)	400	410	420	430	440	450	460	470
Engagement starts at	N1(rpm)	300	307.5	315	322.5	330	337.5	345	352.5
Inner radius	Rd (mm)	200	205	210	215	220	225	230	235
Radius of shoe cog	Rg (mm)	150	155	160	165	170	175	180	185
Coefficient of friction	μ	0.25	0.3	0.25	0.3	0.25	0.3	0.25	0.3